

The Common Operations and Development Environment (CODE) for the WSR-88D Open RPG

CODE B15.0r1.6: November 2014

Includes ORPG Build 15.0r1.6

CODE Introduction

CODE is produced in two versions:

1. The **U.S. Government Edition** of CODE is the complete version. Distribution is limited to within the United States Government.
2. The **Public Edition** of CODE is intended for public release. Certain Copyrighted material has been removed to permit release outside the U.S. Government.

CODE provides:

- Instructions for setting up the development environment (includes ORPG source code)
- Guidance for compiling software and configuring new ORPG tasks & products
- Instructions for definition and use of algorithm adaptation data and algorithm dependent parameters
- API Programming Guide and the structure of WSR-88D algorithms (with sample algorithms)
- WSR-88D specific analysis tools
- A set of WSR-88D Archive II Data files and other special test case data.

CODE User provides:

- An Intel PC with Red Hat Enterprise Workstation Linux.

Start Here:

[Overview of CODE](#)

[System Requirements](#)

[Change History](#)

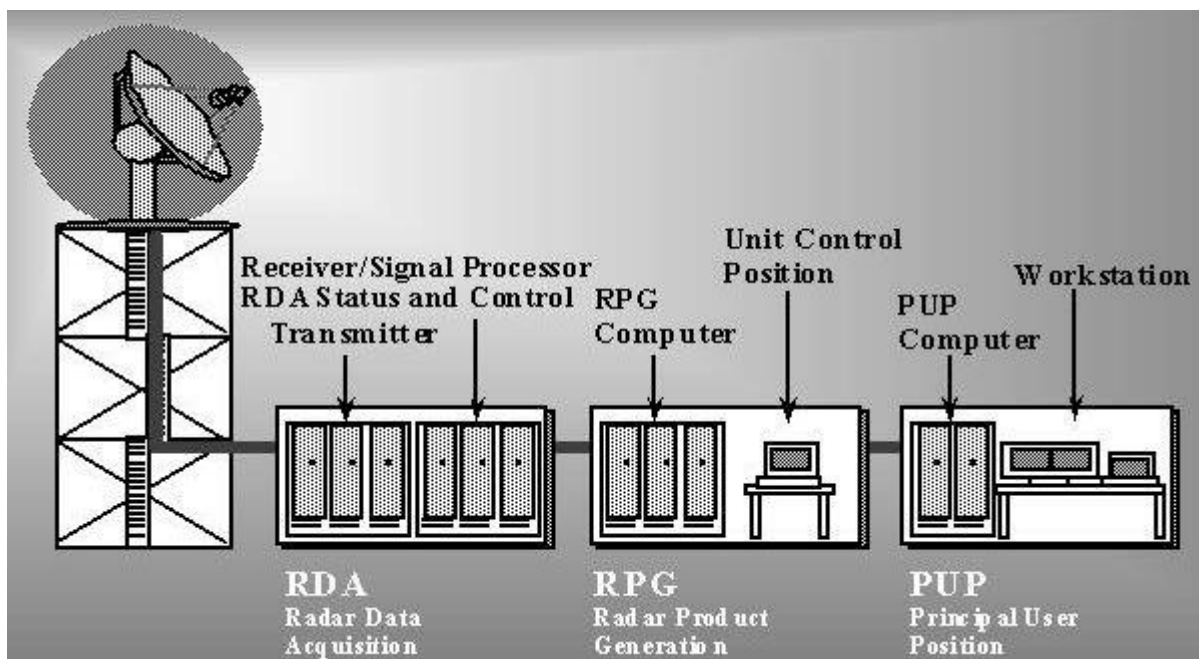
[CODE Documentation](#)

Overview of CODE

The objectives of the Common Operations and Development Environment (CODE) are to greatly enhance the process of meteorological application development, testing, technology transfer, and maintenance for the NEXRAD program.

Introduction

The WSR-88D radar consisted of three subsystems. The RDA includes the radar antenna, transmitter/receiver, and the signal processing computer. The RPG is the radar product generating / distribution computer. The PUP was the integrated product display computer and has been replaced by separate user agency systems.



The RPG, the radar product generation subsystem of the WSR-88D radar, was the first portion of the radar to be redesigned into an open systems architecture and is called the Open RPG (or ORPG).

CODE for the WSR-88D is based upon the capabilities provided by the Open Systems Radar Product Generator (ORPG). ORPG software can be installed and run on a single desktop Intel PC running Red Hat Enterprise Workstation Linux. This "clone" of an operational ORPG does not distribute products to operational users nor control a radar. However, using one of several methods of radar data input, the algorithms running on the ORPG clone utilize services identical to the operational ORPG and can produce products identical to those distributed by an operational system.

Overview of CODE

New algorithms developed on the clone ORPG (assuming these services are used correctly) are much easier to integrate onto the operational system. With the appropriate guidance, new techniques can be more thoroughly tested prior to submission to the NWS Radar Operations Center (ROC). In addition, if the clone is based upon a workstation configured similarly to the operational ORPG hardware, run time performance of new algorithms can be evaluated by the developer.

WSR-88D CODE is targeted for programmers with software development experience in a Unix environment and an appropriate background in Radar Meteorology.

What is CODE?

The Common Operations and Development Environment (CODE) is the primary algorithm development and implementation environment for new science intended for integration into the WSR-88D radar. CODE supports the development and maintenance of WSR-88D algorithms; NOT the ORPG as a whole.

The ORPG design:

- supports ease of expansion and modification,
- includes a layered service architecture that provides a robust but narrow interface between the product algorithms and the rest of the system services, and
- can be run on a single POSIX compliant UNIX workstation.

These design characteristics facilitate an algorithm development environment based on the ORPG itself. CODE is a collection of generic and NEXRAD specific development tools, detailed guidance and documentation that can be used to support both early stages of the algorithm development life cycle (analysis, experimentation, & prototyping) and the later stages of the life cycle (production development, testing, & integration). This development environment is depicted visually below.

Production Development & Integration Environment

Basic Development Tools

- Compilers, linkers, etc.
- Debugging Tools
- Documentation tools

NEXRAD Specific Tools

- WSR-88D Data & Product Display
- Test Tools
- Radar Data Ingest (including test cases)
- Other



ORPG Clone on Desktop Workstation

- **WSR-88D ANSI-C API Services:**
 - The Algorithm API
 - The Common Calculations Library

Documentation & Guidance

- **Vol 1 Installation & Configuration Guide**
- **Vol 2 Algorithm Development Guide**
 - Compiling Software
 - Configuring ORPG for new Algorithms
- **Vol 3 Algorithm Programming Guide**
 - Algorithm API Reference
 - Structure of Algorithms
- **Vol 4 CODE Utility Guide**

Guidance for Formal Integration (under development)

- ANSI-C Coding Standards
- Documentation & Test Requirements

Some of the listed components of CODE are the responsibility of the individual user to obtain (e.g., the workstation and basic development tools beyond generic compilers). The most important components of CODE are

- The capabilities provided by the ORPG algorithm programming interface. Algorithms & products produced with CODE are identical to operational system.
- The extensive documentation and guidance tailored to support algorithm developers rather than ORPG SW maintenance staff or ORPG operators.
- Product display and data analysis tools specifically for NEXRAD products. These utilities provide a convenient means for decoding specified portions of a product as well as providing a graphical display of geographic products.
- Archived Level 2 radar data is available for use. This consists of standard data streams used in formal tests, special artificial test cases, and collections of data containing various meteorological conditions (storms, tornadoes, snow, etc.).

The WSR-88D Algorithm API is complete in that all services are provided for a fully functional operational algorithm. This API is being improved with each build. Documentation for the API is provided with the CODE Guide Volume 3, *WSR-88D Algorithm Programming Guide*.

How do I get CODE?

CODE is available on CD-ROM from the NPI Development manager. The development environment consists of the *ORPG Software Distribution*, a four volume *WSR-88D CODE Guide*, and the *CODE Software Distribution*. The *ORPG Software Distribution* is a recent release obtained from ROC configuration management.

CODE is produced in two versions:

1. **National Weather Service Edition** - This is the complete version of CODE. Distribution is limited to within the National Weather Service and other U.S. Government Agencies.
2. **Public Edition** - This version of CODE is intended for public release. Certain proprietary software components have been removed to permit release outside the U.S. Government.

The Public Edition of CODE using the latest operational ORPG release is also posted on the following web site:

<http://www.weather.gov/code88d/>

If you have visited this site in the past and you do not see the current distribution, you may need to hit the Refresh/Reload button on your web browser.

CODE System Requirements

Build 13 - What's New?

CentOS 5 has been tested and proved as a good alternative Operating System of Red Hat 5.

Build 12 - What's New?

The recommended minimum amount of RAM and swap space for the Development Configuration has been increased from 512 MB to 1 GB.

Build 11 - What's New?

The operational ORPG uses Red Hat Enterprise Linux 5 beginning with Build 11. The ORPG source is built using the compilers included with Red Hat Enterprise 5 (`gcc` has been upgraded to version 4.1.2 and `g77` has been replaced with `gfortran`).

In addition, the Build 11 source code enforces ANSI/POSIX standards and these are required for all Build 11+ software deliveries. One major impact is that C++ style comments using `/**` are not permitted.

The backward compatibility of Red Hat Enterprise 4 with Build 11/12 software has not been fully investigated but changes to makefiles would be required.

Only the Linux PC platform is currently supported for CODE.

General Notes:

Do not attempt to compile the ORPG source code without meeting the system requirements stated below.

- Attempting to use any version of Linux other than **Red Hat Enterprise 5 Desktop with Workstation option**
- Attempting to use versions of compilers not listed

will require changes to the source code and / or modification of makefiles.

Do not attempt to use 64-bit versions of Linux.

Workstation Platform

The **Operational Configuration** provides a development platform that is essentially the same as the operational system. This is not required for algorithm development or implementation. The **Development Configuration** provides an acceptable platform for running an ORPG clone and developing ORPG algorithms but does not match the performance criteria of the operational system.

Performance Testing. Any desktop PC with a current processor and 2 GB of RAM would be sufficient in order to determine the relative performance of an algorithm.

	Operational Configuration (Note 1)	Development Configuration	Notes
Workstation	AMD Opteron 250 Dual Processor	Any PC with a Pentium 4 or equivalent processor.	
Operating System	Red Hat Enterprise 5 Desktop with Workstation Option (32-bit)	Red Hat Enterprise 5 Desktop with Workstation Option (32-bit)	2
Physical Memory	2 GB	1 GB RAM minimum 2 GB recommended	
Swap Space	TBD	1 GB minimum	3
Disk Drive	serial ATA drives	1 GB plus for each ORPG account	4
Display Capability	N/A	24-Bit color, 1024x768 min, 1280x1024 recommended	

Note 1: **With the amount of overhead in the operational system there is little reason to replicate it for development. Any recent quality desktop PC with 2 GB of RAM can be used to obtain a good idea of an algorithms relative performance.**

Note 2: **Red Hat Enterprise 5 Workstation has been selected as the operating system for the deployed ORPG. Enterprise Workstation version 4 may still be compatible with the ORPG but would require changes to makefiles. The ORPG software requires 32-bit operating systems.**

Note 3: **Currently 1 GB of swap space is sufficient for the CODE development environment.**

Note 4: Does not include space for compilers and other development tools.

Software Language Compilers

The CODE Linux platform uses libraries and software development tools that are provided with the basic distribution of Red Hat Enterprise 5 Desktop with Workstation option.

Compilers used to build the Operational ORPG

- **Compilers and utilities provided with Red Hat Enterprise Workstation**
 - GCC 4.1.2 (includes gcc, g++, and gfortran)
 - GNU make 3.81-1.1
 - GNU linker in binutils 2.17.50.0.6-5
 - glibc 2.5-18

CHANGE HISTORY

What's New for CODE B15.0r1.6 (for ORPG Build 15.0r1.6) November 2014

1. **CODE Volume 1 - Guide to Setting Up the Development Environment**
 - Modifications for the new version of ORPG Build 15.0r1.6 software.
 2. **CODE Volume 2 - ORPG Application Development Guide**
 - No change
 3. **CODE Volume 3 - WSR-88D Algorithm Programming Guide**
 - No change
 4. **CODE Volume 4 - CODE Utility Guide**
 - No change
 5. **ORPG Source Code**
 - Updated to ORPG Build 15.0r1.6 November 2014
 6. **CODE Software**
 - Sample Algorithms - version 1.22a
 - No change.
 - CODEview Graphics (CVG) 9.2 (integrated with ORPG B15.0r1.6)
 - No change
 - CODEview Text (CVT) 4.4.3 (integrated with ORPG B15.0r1.6)
 - No change.
-

What's New for CODE B14.1 (for ORPG Build 14.1) May 2014

1. **CODE Volume 1 - Guide to Setting Up the Development Environment**
 - Modifications for the new version of ORPG Build 14.1 software.
2. **CODE Volume 2 - ORPG Application Development Guide**
 - No change
3. **CODE Volume 3 - WSR-88D Algorithm Programming Guide**
 - No change
4. **CODE Volume 4 - CODE Utility Guide**
 - No change
5. **ORPG Source Code**
 - Updated to ORPG Build 14.1 May 2014
6. **CODE Software**
 - Sample Algorithms - version 1.22a
 - No change.
 - CODEview Graphics (CVG) 9.2 (integrated with ORPG B14.1)
 - No change
 - CODEview Text (CVT) 4.4.3 (integrated with ORPG B14.1)
 - No change.

What's New for CODE B14.0r1.17 (for ORPG Build 14.0r1.17) February 2014

1. **CODE Volume 1 - Guide to Setting Up the Development Environment**
 - Modifications for the new version of ORPG Build 14.0r1.17 software.
 2. **CODE Volume 2 - ORPG Application Development Guide**
 - No change
 3. **CODE Volume 3 - WSR-88D Algorithm Programming Guide**
 - No change
 4. **CODE Volume 4 - CODE Utility Guide**
 - No change
 5. **ORPG Source Code**
 - Updated to ORPG Build 14.0r1.17 January 2014
 6. **CODE Software**
 - Sample Algorithms - version 1.22a
 - No change.
 - CODEview Graphics (CVG) 9.2 (integrated with ORPG B14.0r1.17)
 - No change
 - CODEview Text (CVT) 4.4.3 (integrated with ORPG B14.0r1.17)
 - No change.
-

What's New for CODE B14.0r1.14 (for ORPG Build 14.0r1.14) September 2013

1. **CODE Volume 1 - Guide to Setting Up the Development Environment**
 - Modifications for the new version of ORPG Build 14.0r1.14 software.
 2. **CODE Volume 2 - ORPG Application Development Guide**
 - No change
 3. **CODE Volume 3 - WSR-88D Algorithm Programming Guide**
 - No change
 4. **CODE Volume 4 - CODE Utility Guide**
 - No change
 5. **ORPG Source Code**
 - Updated to ORPG Build 14.0r1.14 September 2013
 6. **CODE Software**
 - Sample Algorithms - version 1.22a
 - No change.
 - CODEview Graphics (CVG) 9.2 (integrated with ORPG B14.0r1.14)
 - No change
 - CODEview Text (CVT) 4.4.3 (integrated with ORPG B14.0r1.14)
 - No change.
-

What's New for CODE B14.0r1.7 (for ORPG Build 14.0r1.7) June 2013

1. **CODE Volume 1 - Guide to Setting Up the Development Environment**
 - Modifications for the new version of ORPG Build 14.0r1.7 software.
 2. **CODE Volume 2 - ORPG Application Development Guide**
 - No change
 3. **CODE Volume 3 - WSR-88D Algorithm Programming Guide**
 - No change
 4. **CODE Volume 4 - CODE Utility Guide**
 - No change
 5. **ORPG Source Code**
 - Updated to ORPG Build 14.0r1.7 May 2013
 6. **CODE Software**
 - Sample Algorithms - version 1.22a
 - No change.
 - CODEview Graphics (CVG) 9.2 (integrated with ORPG B14.0r1.7)
 - No change
 - CODEview Text (CVT) 4.4.3 (integrated with ORPG B14.0r1.7)
 - No change.
-

What's New for CODE B13.2 (for ORPG Build 13.2) March 2013

1. **CODE Volume 1 - Guide to Setting Up the Development Environment**
 - Modifications for the new version of ORPG Build 13.2 software.
 2. **CODE Volume 2 - ORPG Application Development Guide**
 - No change
 3. **CODE Volume 3 - WSR-88D Algorithm Programming Guide**
 - No change
 4. **CODE Volume 4 - CODE Utility Guide**
 - No change
 5. **ORPG Source Code**
 - Updated to ORPG Build 13.2 March 2013
 6. **CODE Software**
 - Sample Algorithms - version 1.22a
 - No change.
 - CODEview Graphics (CVG) 9.2 (integrated with ORPG B13.2)
 - No change
 - CODEview Text (CVT) 4.4.3 (integrated with ORPG B13.2)
 - No change.
-

What's New for CODE B13.1r1.7 (for ORPG Build 13.1) February 2013

Change History of CODE

1. **CODE Volume 1 - Guide to Setting Up the Development Environment**
 - Modifications for the new version of ORPG Build 13.1 software.
 2. **CODE Volume 2 - ORPG Application Development Guide**
 - No change
 3. **CODE Volume 3 - WSR-88D Algorithm Programming Guide**
 - No change
 4. **CODE Volume 4 - CODE Utility Guide**
 - No change
 5. **ORPG Source Code**
 - Updated to ORPG Build 13.1 (release 1.7) December 2012
 6. **CODE Software**
 - Sample Algorithms - version 1.22a
 - No change.
 - CODEview Graphics (CVG) 9.2 (integrated with ORPG B13.1)
 - No change
 - CODEview Text (CVT) 4.4.3 (integrated with ORPG B13.1)
 - No change.
-

What's New for CODE B13.0r1.6 (for ORPG Build 13.0) June 2012

1. **CODE Volume 1 - Guide to Setting Up the Development Environment**
 - Modifications for the new version of ORPG Build 13.0 software.
 2. **CODE Volume 2 - ORPG Application Development Guide**
 - No change
 3. **CODE Volume 3 - WSR-88D Algorithm Programming Guide**
 - No change
 4. **CODE Volume 4 - CODE Utility Guide**
 - No change
 5. **ORPG Source Code**
 - Updated to ORPG Build 13.0 (release 1.6) April 2012
 6. **CODE Software**
 - Sample Algorithms - version 1.22a
 - No change.
 - CODEview Graphics (CVG) 9.2 (integrated with ORPG B13.0)
 - No change
 - CODEview Text (CVT) 4.4.3 (integrated with ORPG B13.0)
 - No change.
-

What's New for CODE B13.0r1.4 (for ORPG Build 13.0) February 2012

1. **CODE Volume 1 - Guide to Setting Up the Development Environment**
 - Modifications for the new version of ORPG Build 13.0 software.

Change History of CODE

2. **CODE Volume 2 - ORPG Application Development Guide**
 - No Change
 3. **CODE Volume 3 - WSR-88D Algorithm Programming Guide**
 - No Change
 4. **CODE Volume 4 - CODE Utility Guide**
 - Updated for new version of CVG 9.2.
 5. **ORPG Source Code**
 - Updated to ORPG Build 13.0 (release 1.4) February 2012
 6. **CODE Software**
 - Sample Algorithms - version 1.22a
 - No change.
 - CODEview Graphics (CVG) 9.2 (integrated with ORPG B13.0)
 - Improved display of radial products to greatly reduce the number of black pixels between radials, artifacts of the display resolution and the X-windows drawing primitives.
 - BUG Fixed: The product database size in CVG was smaller than the maximum possible in the RPG. This would cause the display of product other than the product selected for display when using larger product databases.
 - CODEview Text (CVT) 4.4.3 (integrated with ORPG B13.0)
 - No change.
-

What's New for CODE B12.3r1.2 (for ORPG Build 12.3) October 2011

1. **CODE Volume 1 - Guide to Setting Up the Development Environment**
 - Modifications for the new version of ORPG Build 12.3 software.
 2. **CODE Volume 2 - ORPG Application Development Guide**
 - No Change
 3. **CODE Volume 3 - WSR-88D Algorithm Programming Guide**
 - No Change
 4. **CODE Volume 4 - CODE Utility Guide**
 - No Change
 5. **ORPG Source Code**
 - Updated to ORPG Build 12.3 (release 1.2) September 2011
 6. **CODE Software**
 - Sample Algorithms - version 1.22a
 - No change.
 - CODEview Graphics (CVG) 9.1c (integrated with ORPG B12.2)
 - No change.
 - CODEview Text (CVT) 4.4.3 (integrated with ORPG B12.2)
 - No change.
-

What's New for CODE B12.2r1.2 (for ORPG Build 12.2) April 2011

Change History of CODE

1. **CODE Volume 1 - Guide to Setting Up the Development Environment**
 - Modifications for the new version of ORPG Build 12.2 software.
 2. **CODE Volume 2 - ORPG Application Development Guide**
 - See What's New for CODE B12.2r1.1.
 3. **CODE Volume 3 - WSR-88D Algorithm Programming Guide**
 - See What's New for CODE B12.2r1.1.
 4. **CODE Volume 4 - CODE Utility Guide**
 - See What's New for CODE B12.2r1.1.
 5. **ORPG Source Code**
 - Updated to ORPG Build 12.2 (release 1.2) March 2011
 6. **CODE Software**
 - Sample Algorithms - version 1.22a
 - No change.
 - CODEview Graphics (CVG) 9.1c (integrated with ORPG B12.2)
 - No change.
 - CODEview Text (CVT) 4.4.3 (integrated with ORPG B12.2)
 - No change.
-

What's New for CODE B12.2r1.1 (for ORPG Build 12.2) March 2011

1. **CODE Volume 1 - Guide to Setting Up the Development Environment**
 - Modifications for the new version of ORPG Build 12.2 software.
 2. **CODE Volume 2 - ORPG Application Development Guide**
 - See What's New for CODE B12.1r1.10.
 3. **CODE Volume 3 - WSR-88D Algorithm Programming Guide**
 - See What's New for CODE B12.1r1.10.
 4. **CODE Volume 4 - CODE Utility Guide**
 - See What's New for CODE B12.1r1.10.
 5. **ORPG Source Code**
 - Updated to ORPG Build 12.2 (release 1.1) February 2011
 6. **CODE Software**
 - Sample Algorithms - version 1.22a
 - No change.
 - CODEview Graphics (CVG) 9.1c (integrated with ORPG B12.2)
 - No change.
 - CODEview Text (CVT) 4.4.3 (integrated with ORPG B12.2)
 - No change.
-

What's New for CODE B12.1r1.10 (for ORPG Build 12.1) November 2010

1. **CODE Volume 1 - Guide to Setting Up the Development Environment**
 - Modifications for the new version of ORPG Build 12.1 software.

Change History of CODE

2. **CODE Volume 2 - ORPG Application Development Guide**
 - Updated description of base data format corresponding to Build 12.1 rels 1.10 ORPG. This includes 250 m reflectivity bins at all elevations and 300 km Doppler range.
 - See What's New for CODE B12.1r1.6.
 3. **CODE Volume 3 - WSR-88D Algorithm Programming Guide**
 - Documented changes to `RPGC_get_customizing_data()`
 - See What's New for CODE B12.1r1.6.
 4. **CODE Volume 4 - CODE Utility Guide**
 - See What's New for CODE B12.1r1.6.
 5. **ORPG Source Code**
 - Updated to ORPG Build 12.1 (release 1.10) October 2010
 6. **CODE Software**
 - Sample Algorithms - version 1.22a
 - See Volume 3 Document 3 Section II for a description of changes to the sample algorithms.
 - CODEview Graphics (CVG) 9.1c (integrated with ORPG B12.1)
 - See Volume 4 Document 2 for a description of changes.
 - CODEview Text (CVT) 4.4.3 (integrated with ORPG B12.1)
 - See Volume 4 Document 1 for a description of changes.
-

What's New for CODE B12.1r1.6 (for ORPG Build 12.1) September 2010

1. **CODE Volume 1 - Guide to Setting Up the Development Environment**
 - Modifications for the new version of ORPG Build 12.1 software.
2. **CODE Volume 2 - ORPG Application Development Guide**
 - Documented the use of a snippet file for the product generation tables.
 - Documented changes to the encoding/decoding parameters (Scale Offset) for several derived Dual Pol data fields.
 - Added algorithm development guidance to always read the encoding/decoding parameters when reading base data.
 - See What's New for CODE B12.0r1.10.
3. **CODE Volume 3 - WSR-88D Algorithm Programming Guide**
 - A bug with sample algorithm 1 was documented.
 - See What's New for CODE B12.0r1.10.
4. **CODE Volume 4 - CODE Utility Guide**
 - See What's New for CODE B12.0r1.10.
5. **ORPG Source Code**
 - Updated to ORPG Build 12.1 (release 1.6) August 2010
6. **CODE Software**
 - Sample Algorithms - version 1.22a
 - See Volume 3 Document 3 Section II for a description of changes to the sample algorithms.
 - CODEview Graphics (CVG) 9.1c (integrated with ORPG B12.1)
 - See Volume 4 Document 2 for a description of changes.
 - CODEview Text (CVT) 4.4.3 (integrated with ORPG B12.1)

- See Volume 4 Document 1 for a description of changes.

What's New for CODE B12.0r1.10 (for ORPG Build 12.0)

August 2010

1. CODE Volume 1 - Guide to Setting Up the Development Environment

- Modifications for the new version of ORPG Build 12.0 software.
- Updated installation instructions for the new CODE sample algorithms and the CODE utility updates.

2. CODE Volume 2 - ORPG Application Development Guide

- When compiling individual libraries, there are no longer chmod messages concerning changing the permissions of the bzip2 libraries symbolic links
- Updated discussion of high level algorithm design issues. Emphasized that normal meteorological algorithms usually have no need to register for events but listed two situations where an event driven algorithm might be appropriate.
- For data packet 20, point feature data, added the symbol number, current use, and description of all symbols currently defined. Noted that new symbols intended for operational products must be coordinated with the Radar Operations Center during the design review. For CVG display, the development lead for CVG must be notified. See Part C.
- For the area component, noted that even if the following are stated in the product specification ICD, the display attributes for lines, symbols and labels are completely determined by the display device. In the future some effort should be made in defining a set of line and symbol attributes (line thickness, solid / dashed, etc. and label attributes. Standard area component attribute names should also be defined that stipulate the display attributes. For CVG display, the development lead for CVG must be notified. Currently CVG only provides a capability to manually select display attributes from a defined short list. See Part D.
- Modified the description of determining the radial size (number of bins) for clarity and safety. See Part F.
- Corrected the description of the recombination the ORPG accomplishes for the original data registrations. See Parts A, D, and F.
- The recombined rawdata types have been removed, the table in Part D was updated.
- Removed all references to the actual size of the base data header. The size of this structure is subject to change and the `BASEDATA_HD_SIZE` is now defined as `(sizeof(Base_data_header) / sizeof(short))`.
- Added recent guidance for setting edit permissions for algorithm adaptation data.
- Clarified CVG use of threshold fields in the product description block and configuration Method 5 needed for Scale-Offset decoding.
- Noted that CVT also has a Scale-Offset decoding capability.
- Documented the Build 12 base data header.

3. CODE Volume 3 - WSR-88D Algorithm Programming Guide

- Updated discussion of event driven algorithms and the event registration functions. Reemphasized that normal meteorological algorithms usually have no need to register for events. Documented the `ORPGEVT_START_OF_VOLUME_DATA` event as the safest beginning volume event to use in a meteorological algorithm.

Change History of CODE

- Updated discussion of high level algorithm design issues. Emphasized that normal meteorological algorithms usually have no need to register for events but listed two situations where an event driven algorithm might be appropriate
 - Modified the discussion of reading base data and determining radial size (number of bins) for clarity and safety.
 - Emphasized that algorithms producing a product must either successfully produce that product or call the appropriate abort service.
 - Added specific examples for when to use the `PGM_PROD_NOT_GENERATED` abort reason code (including the failure to read a non-product data store).
 - Corrected an error in the documentation of `RPGC_rel_outbuf`. When using the optional output it must be OR the disposition with `RPGC_EXTEND_ARGS`, not `EXTENDED_ARGS_MASK`.
 - Added that `PGM_DISABLED_MOMENT` is also used when a required advanced data field (Dual Pol data) is not in the radial message.
 - Improved the introduction to the API support for Traditional Final Products and the API support for the Generic Data packet. More general information was added and additional references to the details contained in Volume 2 Document 3 were provided.
 - Added guidance for algorithms producing `RADIAL_DATA`. Part C provides limits on input data and output data registration for radial producing algorithms and guidance concerning when radial outputs should be used and when they cannot be used. Part D provides limits on when radial producing algorithms can abort and additional guidance for when there are data problems and the radial is passed along without aborting.
 - Added guidance for measuring algorithm CPU usage.
 - Added guidance for measuring algorithm Memory usage.
 - Expanded guidance for use of `GL_INFO` and `GL_ERROR`.
4. **CODE Volume 4 - CODE Utility Guide**
- Updated for new versions of CVG and CVT.
 - Clarified CVG use of threshold fields in the product description block and configuration Method 5 needed for Scale-Offset decoding.
 - Noted that CVT also has a Scale-Offset decoding capability.
 - Documented two bugs: volume animation with product database buffers that have wrapped several times and a possible minor color selection difference between method 2 and method 5 configuration.
5. **ORPG Source Code**
- Updated to ORPG Build 12.0 (release 1.10) July 2010
6. **CODE Software**
- Sample Algorithms - version 1.22a
 - See Volume 3 Document 3 Section II for a description of changes to the sample algorithms.
 - CODEview Graphics (CVG) 9.1c (integrated with ORPG B12)
 - See Volume 4 Document 2 for a description of changes.
 - CODEview Text (CVT) 4.4.3 (integrated with ORPG B12)
 - See Volume 4 Document 1 for a description of changes.

CODE Guide

Setting Up the ORPG Development Environment



CODE Guide Volume 1. [Guide to Setting Up the Development Environment](#)

Document 1. CODE Specific ORPG Installation Instructions

- I - Preparation for Installation
- II - Installation Instructions
- III - Supplemental Information
- IV - Running the ORPG

Document 2. Installing CODE Software

- I - Software Requisites for CODE Utilities
- II - Instructions for CODE Utilities
- III - Instructions for Sample Algorithms
- IV - Instructions for Dual Pol Test Products

Volume 1 Appendices

Using the ORPG Development Environment



CODE Guide Volume 2. [ORPG Application Software Development Guide](#)

Document 1. The ORPG Architecture

Document 2. The ORPG Development Environment

- I - Integrating Development Software with ORPG Source Code
- II - Compiling Software in the ORPG Environment
- III - ORPG Configuration for Application Developers
- IV - Configuring Site Specific Adaptation Data

Document 3. WSR-88D Final Product Format

- I - Product Block Structure
- II - Traditional Product Data Packets
- III - Generic Product Components
- IV - ORPG Application Dependent Parameters

Document 4. ORPG Internal Data for Algorithm Developers

- I - Base Data Format
- II - Algorithm Adaptation Data - Configuration & Use
- III - Other Data Inputs

Volume 2 Appendices

Writing ORPG Algorithms



CODE Guide Volume 3. [WSR-88D Algorithm Programming Guide](#)

Document 1. The WSR-88D Algorithm API Overview

Document 2. The WSR-88D Algorithm API Reference

- I - API Service Registration / Initialization
- II - Control - Input/Output - Abort Services
- III - Final Product Construction
- IV - API Convenience Functions

Document 3. The WSR-88D Algorithm Structure and Sample Algorithms

Table of Contents of CODE Guide

- I - WSR-88D Algorithm Structure
- II - Sample Algorithms
- III - Writing Product Data Fields

Document 4. Special Topics

- I - Topics Related to Using the Development Environment
- II - Topics Related to Writing Algorithms

Volume 3 Appendices

ORPG Specific Development Utilities



CODE Guide Volume 4. [CODE Utility Guide](#)

Document 1. CODEview Text (CVT)

Document 2. CODEview Graphics (CVG)

- I - Displaying Products with CVG

- II - Configuring Products for Display by CVG

Document 3. Archive II Disk File Ingest - play_a2 Tool

Document 4. Product Distribution with the nbtcp Tool

Document 5. Additional CODE / ORPG Tools

Volume 4 Appendices